

US Forest Service  
Interagency?  
NRO?

# NATIONAL FIRE SUPPRESSION RISK MANAGEMENT PROTOCOL

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## FOREWORD – ESTABLISHING A NEW COMMON CURRENCY FOR FIRE MANAGEMENT.

Managing fire is a risky business. For decades, the Forest Service's Fire and Aviation Management (FAM) organization has undertaken this business in the interests of its mission to protect and enhance the nation's forests and grasslands. Millions of acres of land are protected each year from the risks of wildland fire. In accomplishing this protection, the organization and its stakeholders are exposed to the inherent risks of both actual and potential fires. The Fire and Aviation Management organization operates in a complex environment populated by inherent and unforgiving risks many of which cannot be mitigated to zero and can result in loss of property and human life. Success for the agency's fire management program requires the effective management of these risks, the characteristics and magnitude of which vary greatly depending upon the situation. They can be classified into several categories: safety of the public and incident responders, environmental, ecological, organizational, financial, social and political. All fire management decisions transfer risk among these categories. For example, a decision to engage a fire always transfers risk from values in harm's way to incident responders. Likewise, a decision to suppress a fire today at a relatively small size limits the effect of the fire on existing forest fuels and transfers risk of a larger and more extreme fire to the future.

Evidence of how well the Fire and Aviation Management program does at managing the risks of wildland fire can be seen in the very high success rate with which the organization manages the large number of ignitions that occur each year. It can also be seen in the very low, and virtually zero, frequency with which members of the public experience injury or loss of life due to wildland fire, despite the ever-increasing trend for residential development in close proximity to forested lands.

As a matter of public expectation and government policy, the Forest Service is expected to safely protect the public and the things they value from the harmful effects of wildland fire. When the fire bell rings, fire managers respond. The first thing they think about is how to safely and effectively deal with the fire. The priority that firefighters place on safety and effectiveness is consistent with citizen expectations. Despite the best efforts of incident personnel, bad outcomes are inevitable in this hazardous and uncertain endeavor. If incident responders give the impression that costs drive or limit their actions, fire commanders may fear being accused of caring more about money than protecting public values and lives. Therefore, the motivation is very strong for a fire manager to spare no reasonable expense in meeting incident objectives. The mental model of success for incident managers is to anchor on a "precautionary principle" with respect risk that strongly favors protecting public values in harms way: Even if fire harms the public interest, incident managers will have done everything possible in their efforts to protect life and values.

However, anchoring to the precautionary principle has three significant consequences: (1) most importantly it is problematic from a risk management perspective: In return for attempting to decrease the immediate threat to public values, firefighters may unknowingly accept unnecessary incident risk, and ecosystem risk (e.g., increasing fuel burden) may be transferred to the future, (2) it promotes a style of risk management that may not adequately weigh the magnitude of incident



response against the near-term and long-term effects of wildland fire, and (3) it may not adequately reflect the principles of governance with respect to risk-based decision making and cost consciousness to which the agency aspires.

In recent years, the common currency that the Forest Service's Fire & Aviation Management program has used to keep score is dollar cost, with the result that cost has become a major operational focal point and a significant indicator to stakeholders of the performance of the program. However, the attention the organization gives to cost is masking a much more important problem concerning management of the inherent risks of wildland fire, including risks to the public and incident responders as well as risks to the ecosystem from the enormous fuel burden that continues to accumulate and that poses escalating risks of future fire. It is of paramount importance that the Forest Service shifts the common currency from focusing on costs to managing risks. The consequences of not doing so are significant: public well being, firefighters lives, ecosystem health and taxpayer capital are at stake. The system that has evolved around federal wildland firefighting is unsustainable with respect to desirable outcomes. Establishing effective risk management as the common currency is the precursor to achieving more desirable outcomes with respect to protection of the public and firefighters, as well as protecting and improving ecosystem health.

Establishing a new common currency based on risk management will create an organization that is known as being safe, effective, accountable, continually improving and provides a good investment of taxpayer capital. This new currency requires that the organization shift to a risk informed measured response based on the best available risk and decision science, as well as a national-level system of monitoring and governance that assures the proper alignment of risk-based decision making and cost consciousness.

The purpose of this Protocol is to begin the journey of creating the new currency of risk management. We expect that the effective use of this protocol will lead to understanding, acceptance and support among stakeholders that costs are truly an outcome of decisions made in the course of managing the inherent risks of fire on the landscape.



## CHAPTER ONE - BACKGROUND

### WHERE WE ARE TODAY

The history of the USDA Forest Service is one of responsiveness to social values and needs. In the past several decades, we have seen dramatic changes that impact how the Forest Service fulfills its mission. Where at one time the Forest Service managed fire predominantly to protect natural resource commodity values, today the agency manages to a multi-use mission that serves a broad range of public interests.

Changing conditions and increasing complexity are two features of fire management today. Climate change, ecosystem imbalances and the expansion of Wildland-Urban Interface (WUI) are part of the reality that fire management must address. As a result, the need for fire management is both highly variable from year to year and changes over time. The factors responsible for fire suppression need are often not under the agency's control. However, the agency is responsible for responding to the need for fire suppression at whatever level it occurs.

Over the past decade, suppression costs have been increasing at an alarming rate and concerns have been expressed that the Forest Service fire suppression expenditures are out of control. These concerns have led to budgeting fire suppression costs based on a 10-year moving average within the agency budgetary constraint. This results in significant fiscal impacts to other program areas, such as recreation and wildlife, when the 10-year average increases. Consequences include serious criticism from the public about the agency's ability to fulfill expectations with regard to its multi-use mission. Fire management and related funding now account for approximately 50% of the total agency budget, up from XX% just X years ago. A serious impact of this trend is the need to transfer funds from other non-fire program areas to cover fire-related expenditures when suppression funds run out.

**Comment [DM1]:** This needs a tighter and stronger conclusion.

### WHERE WE NEED TO GO IN THE FUTURE

There are no easy answers to the questions and challenges we face, and it is very clear that the Forest Service must look to adaptive leadership to help society deal with the vexing issues and trends related to fire management of America's fire-adapted landscapes. The current system is not sustainable for either the Forest Service or society. Ultimately, the system needs to be modified to check the course of the troubling trends we see today. Fire must be restored to fire-adapted ecosystems. Communities must learn to live with fire. Firefighters need to lead the safe return of fire to the landscape, based on a new and coherent culture of working productively with fire. Forest Service leaders must design a financial system that provides incentives to achieve successful outcomes. The aim of this Protocol is to help begin the journey towards making these significant changes.



In making these changes we recognize that solutions have to begin on one scale and move to multiple scales that include all levels of management and jurisdictions (e.g., national, regional, forest, district). The present version of the Protocol applies to the USDA Forest Service, and ultimately will need to extend to our interagency partners in fire and resource management. Our concern in this Protocol is for *High*, *Very High* and *Extreme Risk* fires. We begin at the high end of the risk dimension to reflect our and society's most recent concerns; in subsequent protocols the scope will extend to all risk levels. Our direction is toward establishing a partnership with the scientific community as the Protocol incorporates leading-edge research on the best practices to return fire to adapted ecosystems and to implement performance measurement based on sound scientific principles.

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## THE NEED FOR CHANGE IN FIRE SUPPRESSION MANAGEMENT

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Fire plays a complex role in ecosystem management. On the one hand, fire is a natural event and is a part of nature's balance in maintaining ecosystem health. On the other hand, fire is a destructive force that threatens things that humans value. In managing fire, a constant concern is the appropriateness of the fire management response in light of the risks that fire poses and the benefits that it provides. Accounting for the costs of fire management is, like fire, complex and has not always been consistent, nor have various stakeholders agreed that costs are adequately managed. Congressionally-mandated large fire costs reviews have, to date, not identified any significant systemic problems with how the agency's fire suppression budget is managed. Although no specific problems have been identified, the agency is committed to improving cost efficiency and effectiveness through a fully accountable system that has:

- Clear expectations for success,
- Clear identification of responsible officials,
- Clear identification and expectations of oversight officials,
- Effective performance measures,
- Effective monitoring,
- An effective error detection and correction process, and
- An effective process that accounts for deviations from expectations.

Of these seven requirements, the current system has in place the first two components. This Protocol has as one of its primary aims the establishment of a framework for accountability by implementing an effective governance system that puts in place all seven components required for an effective accountability system.

At the heart of the challenge to establish a system of accountability based on these seven requirements is the development of a risk management approach that considers the full range of risks associated with fire, including risks to incident responders, to the public, and to the ecosystem. To meet this challenge requires a corporate-level Protocol for risk management that guides strategic-level decision making and that uses risk assessment and risk management principles.



Under this Protocol, incident-level strategic decisions to manage fire are analyzed and documented in terms of the exposure of incident responders to the hazards of wildland fire. This is critical because firefighting has inherent risks that, even when mitigated, can result in significant injury or death to incident responders.

Because inherent risks cannot be mitigated to zero, it is vitally important that managers use risk management principles. Successful risk management implements the following fundamental principles:

- Accept risk when benefits outweigh the risk.
- Accept no unnecessary risk.
- Anticipate and manage risk by planning.
- Make risk decisions at the appropriate level.

Accountable incident management is based on a risk-informed, measured response. A measured response compares a Prospect Fire against the risk to incident responders. A Prospect Fire is a scenario under which a fire can reasonably and confidently be concluded in space and time. Making an intentional tradeoff between the potential benefits of achieving the Prospect Fire and the risks to incident responders establishes a framework for accountability. When the agency decision maker considers the question of how many incident responders to put at risk to achieve the Prospect Fire, he or she establishes a benchmark that defines acceptable exposure provided the amount of exposure is within a range of acceptability based on production standards.

If every incident is managed within the context of accountability, as described above, each incident can be evaluated against what managers said that they would do, therefore establishing a benchmark for success. If every incident has a determination of success, then the agency can be evaluated for system performance. If system performance indicates that all incidents were managed according to expectation, then the agency has successfully managed the suppression program. And, if all incidents are managed successfully and the Forest Service suppression account runs out of funds, then it is entirely due to the demand for fire suppression exceeding the supply.

To bring about these conditions, the fire management program needs to make important changes in three key areas: (a) the implementation of risk management at all levels of the organization – incident to national, (b) the application of performance evaluation to the national fire suppression system and (c) the development of governance approaches that provide national-level oversight and accountability for incident-level decisions and outcomes. The result of changes in these three key areas, and particularly on the 0.25% of fires that result in the majority of the agency's fire suppression costs, are expected to include:

- Decisions that lead to appropriate levels of resource utilization consistent with an identified and documented Prospect Fire,
- A performance feedback control system in place for large fire management.
- Improved allocations of resources across all fire incidents.
- Improved effectiveness and efficiency of operations.



- Risk-informed decision making that takes into account risks to incident responders, the public, and the ecosystem.
- Application of a consistent approach to risk assessment and risk management.
- Risk sharing of decisions and communication of risk both horizontally, with stakeholders, and vertically with upper levels of management authority.
- Effective real time monitoring to detect and correct anticipated errors.

To bring about these changes requires integrating elements of centralized management with the highly decentralized management structure under which the Forest Service currently operates. The National Forests and Grasslands in the National Forest System have been partly identified based on their environmental and ecosystem characteristics. Effective and efficient resource management of these diverse units is predicated on recognizing their unique management problems. By extension, this concept has been applied to fire management as well. As a result, incident management is guided heavily by local Agency Administrators and Incident Commanders operating on the basis of locally-defined resource and fire management plans.

From the perspective of national-level management, the pathway forward is one of ensuring consistent quality in large fire management decision making, while at the same time preserving incident-level focus. Unique management situations demand decentralized decision making, particularly with respect to the speed, agility and focus necessary to manage the inherent risks of wildland fire. Decision making must be incident scale, but with a Protocol that builds capacity for consistency and for the upward engagement of management authority should conditions arise that warrant such actions. In this endeavor, we are committed to retaining the best features of a decentralized organization and also to adopt a corporate approach to risk management, risk sharing, management oversight, performance monitoring and organizational governance.

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## THE CHANGING NEED FOR FIRE SUPPRESSION MANAGEMENT – A SYSTEMS PERSPECTIVE

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The management of fire suppression on the nation's forests and grasslands is a complex undertaking that involves the interaction of factors both internal and external to the agency. This complexity goes beyond procedures and extends into the larger context within which fire management occurs, including the changing condition of lands, the growth of management responsibilities with respect to Wildland Urban Interface (WUI), the level of responsiveness associated with initial attack, and the way in which fire management is funded and budgeted. These factors comprise a *system* within which interconnected relationships influence one another.<sup>1</sup>

This Protocol addresses the *need for change* within the agency by taking appropriate management actions where the agency has the opportunity for management control. At the same time it is critical to identify where the agency acts in response to larger environmental, social and

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<sup>1</sup> See Appendix \_\_\_\_ for a more complete discuss of the concepts contained in this section.



political conditions that are driven by factors external to the agency. It is these external factors that drive the *changing need for fire suppression services*.

In real-world problems all things are interconnected, and the actions we take have effects and impacts on multiple levels and scales. This relatively simple premise means that to account for agency actions requires an accounting in terms of a system of factors that lead to the fire management situation as it is today and that result in a changing need for suppression management services in the future. Although response to fire incidents of all sizes and risk classes is at the core of fire management preparedness and operations, the overall fire management enterprise both depends upon and reacts to five overarching and interrelated components:

- Land conditions and particularly the burden of hazardous fuel present,
- Changing climate conditions,
- The type and amount of human habitation in proximity to forested lands (e.g., WUI),
- The agency's internal culture with respect to management focus and objectives, and
- How the fire program is funded.

In this system, a management action that affects any one component in turn affects the others. For example, changes in the amount of WUI influences the ability to manage incidents in a way that achieves ecosystem benefits, such as hazardous fuel reduction. Increases in hazardous fuels increases the likelihood that of the approximately 10,000 ignitions that do occur each year the incident response will be such that full suppression is called for to mitigate the risk of damage or loss to critical infrastructure. The resulting effect is to further increase the burden of fuels on national forests.<sup>2</sup>

In addition to fuels, incident management response is influenced by human habitation in the WUI. The amount of WUI is affected (a) by fire management factors, particularly success in Initial Attack (IA) that reduces the risk associated with infrastructure development in the WUI, and (b) by factors external to the agency and are associated with population increases, preferences for living styles and incentives to develop lands in close proximity to national forests.<sup>3</sup> At present, the amount of WUI is increasing yearly, thereby influencing the need to maintain a high success rate in IA.

This Protocol develops its approach and management directives based on the system perspective outlined here. The Protocol recognizes that there is a need for change in fire management to improve efficiency and accountability through the development of appropriate governance, monitoring and oversight, and performance metrics that set standards by which management can gauge improvement. At the same time, the Protocol also recognizes that there is a *changing need for suppression resources* driven by factors external to the agency. Improving management efficiencies can provide corrective inputs to this system up to a point, beyond which the changing need for suppression services will require taking actions on a broader scale.

<sup>2</sup> At present, the amount of fuels ingrowth exceeds the outgrowth due to fuel treatment and unplanned wildland fire Reference(s) here to the fuels problem. Information on increase in biomass, etc.

<sup>3</sup> Reference(s) here to the rate of growth of WUI and/or other factors relating to increase in WUI (e.g., incentives, population growth). Is there anything on appreciation in real estate values in the WUI compared to that of similar properties no in the WUI?



## CHAPTER TWO – NATIONAL FIRE SUPPRESSION RISK MANAGEMENT PROTOCOL

### AIMS OF THE PROTOCOL

This Protocol recognizes and provides for two aspects of change: The first is the *need for change* with respect to how fire management decisions are made, how national-level oversight and accountability takes places and how fire suppression system performance is evaluated. The second is the *changing need* for fire management and suppression that occurs as a result of environmental and social changes to which the agency responds in accord with its public mission.

The Protocol has three primary aims: (1) implementation of procedures for managing the inherent risks of the suppression program, (2) implementation of a strategy for learning how to manage the largest .25% of fires in a more safe and effective manner, and (3) establishment of a framework for governance of the national fire suppression program. These aims are met through improving the quality of adaptation to changing fire management conditions.

The Protocol does not suggest nor does it provide for the centralization of fire management services. The Protocol recognizes the value of decentralization of incident management and seeks to retain its benefits while at the same time improving the overall management of the suppression program.

The expected outcomes of implementing this Protocol are: (1) improvement of safety for the public and incident responders, (2) improvement of decisions that determine safety, land health and investments, and (3) demonstration of good governance through the use of corporate management principles as identified in effective protocols.

### RELATIONSHIP OF THE PROTOCOL TO NATIONAL FIRE MANAGEMENT POLICY

This Protocol is consistent with USDA Forest Service policy and reflects key elements of risk management embedded in agency policy direction. Following significant catastrophes, including the loss of life and property, in 1994 and 2000, both the Secretary of Agriculture and Secretary of Interior developed and then improved a coherent federal wildland fire policy. Specific risk management principles and concepts are included in the language of the **Federal Wildland Fire Policy and subsequent Forest Service Manual direction**. The Secretarial directed interagency efforts of both 1995 and 2001 resulted in nine (9) guiding principals and seventeen (17) policy statements for all federal wildland fire agencies. These principals and statements have been translated into

**Comment [DM2]:** John – This is Tom's contribution. I think it is good to have this and I wonder if we can cut it down a bit. Any suggestions here would be welcomed.

**Comment [DM3]:** Citations here to both documents.



policy by the Chief of the USDA Forest Service. The declarations in the Forest Service Manual guide agency actions. The Forest Service has also adopted doctrine to guide firefighting actions.

Risk management is inherent in the nine guiding principals, the seventeen policy statements, in the Forest Service Manual, and the Fire Suppression Doctrine. Interagency guiding principles which specifically note risk management are:

Principle Number (1): Firefighter and public safety is the first priority in every fire management activity.

Principle Number (4): Sound risk management is a foundation for all fire management activities. Risk and uncertainties relating to fire management activities must be understood, analyzed, communicated, and managed as they relate to the cost of either doing or not doing an activity. Net gains to the public benefit will be an important component of decisions.

Interagency policy statements applicable to risk management are:

Safety – Firefighter and public safety is the first priority. All Fire Management Plans and activities must reflect this commitment.

Response to Wildland Fire - ....Response to wildland fires is based on ecological, social, and legal consequences of the fire. The circumstances under which a fire occurs and the likely consequences on firefighter and public safety and welfare, natural and cultural resources, and values to be protected, dictate the appropriate response to fire.

Protection Priorities – The protection of human life is the single, overriding suppression priority. Setting priorities among protecting human communities and community infrastructure, other property and improvements, and natural and cultural resources will be done based on the values to be protected, human health, and safety and the costs of protection. Once people have been committed to an incident, these human resources become the highest value to be protected.

Suppression – Fires are suppressed at minimum cost, considering firefighter and public safety, benefits, and all values to be protected, consistent with resource objectives.

The specific principles and policy statements noted above are noted as Forest Service policy in the Fire Management (5100) portion of the manual. Specific Forest Service manual (FSM) citations occur in FSM 5100 zero code, FSM 5102, FSM 5103, and FSM 5107.

As an additional key element of risk management, Forest Service Fire Suppression doctrine guides agency actions. The specific key statement from the Forest Service fire suppression doctrine (issued by the Chief as direction in 2005) states: “No resource or facility is worth the loss of life; however, the wildland fire environment is complex and possesses inherent hazards that can – even

**Comment [DM4]:** Citation required here.

**Comment [DM5]:** Are these exact quotes from the relevant publications? If so, they should be set off with quotations marks and page numbers to the relevant publications should be provided in the text.

**Comment [DM6]:** Citation and page numbers for these two principles.

**Comment [DM7]:** Citation needed to the Chief's direction for 2005).



with reasonable mitigation – result in harm to firefighters engaged in fire suppression operations. In recognition of this fact, we are committed to aggressive management of risk.” (pg. XXX).

Risk management is critical to both current and future fire and aviation management efforts.

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## GOALS AND OBJECTIVES OF THE PROTOCOL

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### Long-Term Goals and Objectives

- Establishment and implementation of an effective agency governance system for the National Fire Suppression Program that is able to account for investments that drive fire outcomes.
- Fielding emergency response to fire incidents that is guided by measurable benchmarks for success.
- Development and fielding of measurable expectations and performance measures for fire incidents.
- Re-orientation of agency fire culture in the direction of risk-informed decision making.
- Effective implementation of operational risk management approaches to manage the inherent risks of fire.
- Improvement in the restoration rate of fire-adapted ecosystems in order to put these systems on a trend toward sustainability.

### Five-Year Goals

- Implement of a risk informed measured response to *Very High* and *Extreme Risk* fires.
- Explicitly manage exposure to inherent incident management risks.
- Develop, test and deploy science-based performance measures and create an annual performance report comparing one fire to another and one season to the past fire years.
- Demonstrate that each fire response was no more or less than necessary to achieve reasonable objectives.

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## PROTOCOL FRAMEWORK FOR GOVERNANCE

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The essence of governance is the regulation of organizational activities such that clear lines of authority are established by which oversight and monitoring are used to maintain outcomes within the bounds of management expectations and accountability. This Protocol establishes a system of governance to achieve these purposes. Critical to the effectiveness of this system is the recognition that error is normal to complex activities such as fire management, and departures from management expectations do not necessarily reflect negligence or incompetence. Indeed, the



process of organization learning that occurs within High Reliability Organizations (HRO) is predicated on error as a resource for understanding how complex systems can be improved.<sup>4</sup>

To assure that governance established under this Protocol is consistent with the principles of HRO, we hold the perspective that management decisions are based upon where our limited resources can be applied to minimize the risk of harm, and knowing our system is comprised of sometimes faulty equipment, imperfect processes, and fallible human beings. We adopt the concept of a Just Culture that is “just” to all concerned and that (a) encourages the observance of conditions that lead to potential hazard or to departure from management expectations, (b) encourages blame-free and punitive-free reporting of error conditions, and (c) draws a clear distinction between intentional or willful harm and normal actions or omissions that are inherent to human systems.<sup>5</sup>

**Responsibilities of Agency Officials**

Effective governance systems establish clear lines of responsibility and oversight. The Forest Service national fire suppression governance system establishes the following lines of responsibility and oversight for fires according to risk category.<sup>6</sup>

**Comment [DM8]:** At least one reviewer stumbled over cost as an indicator of risk. I've removed the cost column in this table. I can add it back in if it is needed.

Risk Category	Management Response	Responsible Official	Oversight Official
Low	Initial Attack: Fires requiring a Type 4 or 5 IC	District Ranger	Forest Supervisor
Moderate	Extended Attack: Fires requiring a Type 3 IC.	Forest Supervisor	Regional Forester
High	Moderate Risk fires for which a complexity analysis indicates the need for a Type 1 or 2 IMT.	Forest Supervisor	Regional Forester
Very High	High Risk fires for which a complexity analysis indicates the need for a Type 1 IMT.	Regional Forester	Chief of the Forest Service
Extreme	Mega Fires that have a high probability to produce high safety and financial concern and for which a complexity analysis indicates the need for a Type 1 IMT.	Regional Forester	Chief of the Forest Service

*District Ranger*

**Responsible Official Expectations**

Responsible Officials are expected to provide management of the following elements and according to the indicated performance measures:

Management Element	Performance Measurement
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<sup>4</sup> Wieck, K. E., & Sutcliffe, K. M. (2001). *Managing the unexpected*. San Francisco, CA: Jossey-Bass.  
<sup>5</sup> Dekker, S. (2007). *Just culture: Balancing safety and accountability*. Oxon, UK: Ashgate Publishing.  
<sup>6</sup> At the time of this writing, a system for categorizing fires according to risk level was under development. Future versions of the Protocol will refer to this system once it is in place.



Safety of the public and incident responders.	<ul style="list-style-type: none"> <li>• Incident accident statistics</li> <li>• Exposure Index</li> <li>• Use of risk management, assessment and mitigation</li> <li>• After action review</li> </ul>
Implementation of strategies and tactics that have a reasonable probability of success.	<ul style="list-style-type: none"> <li>• Analysis of implemented actions compared to a timeline of probability of containment</li> <li>• Exposure Index</li> <li>• After action review</li> </ul>
Use no more nor less the amount of resources required to achieve reasonable protection goals and objectives.	<ul style="list-style-type: none"> <li>• Exposure Index</li> <li>• After action review</li> </ul>
Maintain or enhance relationships with cooperators (e.g., States).	<ul style="list-style-type: none"> <li>• Pre-season engagement measures</li> <li>• Cooperator surveys.</li> </ul>
Maintain or enhance relationships with stakeholders.	<ul style="list-style-type: none"> <li>• Stakeholder surveys.</li> <li>• Outreach activity measures</li> </ul>
Protection of defendable property only when safe to do so and consistent with Forest Service structure protection policy.	<ul style="list-style-type: none"> <li>• Analysis of implemented actions compared with fire behavior</li> <li>• Incident statistics</li> <li>• After action review</li> </ul>
Protect other resource values when safe to do so and when probability of success is reasonable.	<ul style="list-style-type: none"> <li>• Qualitative assessment</li> <li>• After action review</li> </ul>
Mitigate critical resource/landscape damage.	<ul style="list-style-type: none"> <li>• Effectiveness of BAER</li> </ul>
Insure that potential mission success is worth mission risk to responders.	<ul style="list-style-type: none"> <li>• Use of intentional risk management process</li> <li>• After action review</li> </ul>
Improve ecological conditions where and when possible.	<ul style="list-style-type: none"> <li>• Objectives consistent with Land Management Plans</li> <li>• After action review</li> </ul>

### Oversight Official Expectations

Oversight Officials are responsible for holding Responsible Officials accountable for expectations. Oversight is accomplished by:

- Monitoring key management elements with the intention to detect and correct potential concerns during an incident.
- Using performance measures as indicators of how well expectations are being accomplished.
- Intervention if indicators suggest potential concerns.
- Verification of potential concerns to learn more.
- Contacting and resolving the concern situation with the Responsible Official.
- Requiring Responsible Officials to account for deviations from expectations.

### Accountability



Accountability in governance refers to the acknowledgement and assumption of responsibility for decisions and actions. When properly applied in a governance system, accountability addresses the following types of questions:

- Who is accountable and under what conditions?
- What constitutes an adequate accounting?
- When should the accounting be given?
- In what form should the accounting be given?
- What actions, if any, should be taken conditional on the accounting?

The system of accountability established in this Protocol is based on (1) the identification of lines of management authority, responsibility and oversight, (2) clearly established expectations with respect to success, (3) the identification and application of performance measures associated with key management elements, (4) communication of performance measures to Responsible and Oversight Officials, and (5) monitoring of performance measures by Oversight Officials to detect performance conditions that call for verification and accounting by Responsible Officials.

### Continuous Improvement Through Monitoring, Intervention and Review

This Protocol provides for the continuous improvement of the fire suppression program through comprehensive risk assessment and the application of risk management principles supported by a framework for governance and accountability. We conceptualize this as a closed-loop learning process by which established expectations are the reference points against which performance is compared. The results of the comparison are monitored and acted upon by program management according to an established framework of interventions that include identification, verification, accountability and resolution.

Within this objective framework, continuous improvement occurs at two levels. At the *incident management level*, continuous improvement is in response to the oversight-initiated interventions that occur when incident performance measures depart in a significant pattern from expectations. Monitoring and intervention provide corrective feedback to restore performance to levels consistent with those based on incident management guidelines established in the National Incident Management Protocol.

At the *systemic level*, continuous improvement is a response to seasonal reviews that analyze and draw conclusions about the performance of the management of incidents overall, and that identify organizational changes that can bring the system into accord with the objectives of the fire suppression program. The process of continuous improvement process is enabled by the governance principles established within this Protocol.



## ANNUAL RISK MITIGATION PLAN

### Overview of the Annual Risk Mitigation Plan

The Annual Risk Mitigation Plan defines the mitigation management approach with respect to the risks identified in the Annual National Fire Suppression Risk Assessment (see Chapter 3). The Risk Mitigation Plan is comprised of three key components, two of which are Protocols for (a) National Incident Management, and (b) National Fire Suppression Risk Management. The National Incident Management Protocol established the basis for the management of Very High and Extreme Risk fires by NIMO.<sup>7</sup> The National Fire Suppression Risk Management Protocol establishes a management approach at the national level in terms of real-time monitoring and intervention. The third component of the Plan is the establishment of the National Wildland Fire Decision Support Center (WFDSC) as a central monitoring and reporting entity to support the information requirements of this Protocol, and to support incident operations through technical and decision support consulting. With respect to WFDSC, this Protocol:

- Establishes a basis for how fires are classified with respect to risk;
- Identifies relevant performance metrics, including how they are summarized and reported;
- Defines the role of the *Large Fire Monitor* in obtaining and reporting monitoring information;
- Identifies the role of WFDSC in supporting performance measurement; and
- Identifies incident data and documentation requirements.

The Annual Risk Mitigation Plan is based on a situational analysis that uses risk assessment as a framework for identifying and prioritizing risk issues on an annual basis. Each year, the risk assessment is reviewed and updated to reflect current conditions with respect to such factors as forest and ecosystem health, extent and quality of Wildland-Urban Interface, changes in environmental conditions including climate and vegetation, status of the fire organization with respect to suppression resource availability, and other factors that affect the larger risk picture to which the agency must address its fire management efforts.

From the annually-updated risk assessment a risk mitigation plan is prepared that identifies a set of strategies to address priority risk issues. In this year, the three components of the Annual Risk Mitigation Plan identified above constitute the key strategies for mitigating the risks of wildland fire through risk-based decision making and the implementation of Protocols that provide focused direction for fire management from the incident level to the national level.

<sup>7</sup> In subsequent years, the National Incident Management Protocol will be extended to Incident Management Teams other than NIMO.

**Comment [F9]:** Don, What do you think about inserting a section, either within the Annual Risk Mitigation Plan or a separate section that discusses "Situational Analysis?" The section could (1) discuss the general risk picture, (2) provide a sense of priority of issues and (3) discuss the sequencing of the strategies.



### Develop and Implement the National Incident Management Protocol (NIRMP) for use by NIMO.

The National Incident Management Protocol is used for those incidents on which NIMO is assigned as an Incident Management Team (IMT). The Protocol provides essential guidance on the role of the Agency Administrator and Incident Commander with respect to risk management and the development of fire management strategies based on a Fire Prospect. Incidents managed under this Protocol are those identified as Very High and Extreme Risk. Preseason engagement with Agency Administrators of forests identified as at-risk for fires in these two risk classifications provide the basis for a collaborative working relationship between the Agency Administrator and the Incident Commander. In addition, preseason engagement with forests deemed at-risk provide opportunities to engage local fire staff in simulation exercises that high risk-based decision making principles, and to work with non-federal cooperators to build relationships to support coordinated management should an incident occur.

### Develop and Implement the National Fire Suppression Risk Management Protocol

- Establish a framework for governance.
- Implement a consistent risk management approach for *Very High* and *Extreme Risk* incidents.
- Establish NIMO to lead learning effort.
- Provide for preseason preparedness and capacity development.
- Provide for incident management.
- Provide for after-action peer reviewed of season activities.

### Implement Real-time Monitoring and Intervention

Effective governance entails monitoring by oversight officials and intervening to correct deviations from management expectations. The broad objective of monitoring is to insure success with respect to the overall suppression program objectives and to provide for documentation and archiving of management expectations. This Protocol recognizes that monitoring and intervention must operate at multiple scales from national-level management down to the district level. The focus in this version of the Protocol is on the highest levels of management where the Protocol principles can be implemented and refined, with downward migration in subsequent years.

In implementing the monitoring and intervention aspects of governance we affirm that the approach we take here is consistent with the principles of a High Reliability Organization in its recognition that the identification of error is part of a normal condition and reflects opportunities to improve organizational performance. In line with the concepts of a Just Culture, monitoring and intervention are done without intent to punish or blame, but rather to complete the governance cycle by improving reliability through oversight, accountability and systematic measurement of performance.



Trigger Response Level	Modes, Actions and Accountability	Narrative
Inquiry	<ul style="list-style-type: none"> <li>• Mode: Verbal (e.g., telephone).</li> <li>• Open a line of communication.</li> <li>• Verify with the responsible official the level of the metric.</li> <li>• Accountability: Obtain an overall situation assessment.</li> <li>• <b>Accountability:</b> Obtain official's best assessment of factors that caused the metric to be triggered, their duration and likely influence on subsequent incident management.</li> </ul>	An <i>Inquiry</i> will be initiated whenever a metric meets or exceeds its trigger point. The intention is to open a line of communication with the responsible official, verify the trigger and its cause, and gather related information. The mode is verbal and requires no written or documented response from the responsible official.
Notification of Concern	<ul style="list-style-type: none"> <li>• Mode: Written (e.g., electronic).</li> <li>• Identify the metric and its trigger value(s).</li> <li>• Identify the level of the metric to avoid subsequent triggers.</li> <li>• <b>Accountability:</b> Request verbal and written justification from the appropriate official.</li> </ul>	A <i>Notification of Concern</i> will be initiated whenever a metric meets or exceeds its trigger point by a predetermined frequency (e.g., three triggers per week) or length of time (e.g., days).
Decision Monitoring	<ul style="list-style-type: none"> <li>• Mode: Written and Verbal.</li> <li>• Identify the metric and its trigger value(s).</li> <li>• Identify previous trigger responses (e.g., Notification of Concern).</li> <li>• Identify incident decisions relating to the metric and its trigger.</li> <li>• <b>Accountability:</b> Request (require?) that incident decisions pertaining to the metric be forwarded for monitoring and review.</li> </ul>	<i>Decision Monitoring</i> will be initiated whenever a metric continues to meet or exceed its trigger point after a <i>Notification of Concern</i> has been made. Responsible official continues to manage incident, and forwards key decisions for monitoring and review.
Collaborative Engagement	<ul style="list-style-type: none"> <li>• Mode: Written and Verbal</li> <li>• Identify the metric and its trigger value(s)</li> <li>• Identify previous trigger responses</li> <li>• <b>Accountability:</b> Establish incident management by collaborative engagement.</li> </ul>	<i>Collaborative Engagement</i> will be initiated whenever a metric continues to meet or exceed its trigger point and after <i>Decision Monitoring</i> has not improved performance. At this level, the oversight official and the responsible official collaboratively manage the incident including the formulation of strategies and tactics that influence the metric.
Incident Reassignment	<ul style="list-style-type: none"> <li>• Mode: Written and Verbal</li> <li>• <b>Accountability:</b> Documented history of incident management, including metric triggers, management responses to triggers and resulting outcomes.</li> <li>• <b>Accountability:</b> Establish incident under new incident management.</li> </ul>	<i>Incident Reassignment</i> will be initiated whenever <i>Collaborative Engagement</i> does not result in improved incident performance and/or the collaboration proves unsuccessful on other grounds.



## **Establish National Wildland Fire Decision Support Center (NWFDSC)**

This Protocol establishes the National Wildland Fire Decision Support Center (WFDSC) and defines its purpose, role and functions with respect to real-time monitoring and intervention for wildland fire management.

### **Purpose of the WFDSC**

The purpose of the National Wildland Fire Decision Support Center is to provide focused support for decision making on large and long duration Forest Service wildland fires. This single focal point will support agency goals of large fire risk management and monitoring by providing improved and consistent decision support for large and potentially large wildland fires, improving capability to make strategic decisions through a directed research program, and increasing agency awareness and use of decision support information for risk-informed decision making.

The National Wildland Fire Decision Support Center will promote the cause of large fire decision making and cost management and integrate a number of Forest Service units in this effort, including: Wildland Fire Management RD&A (RMRS); Human Factors and Risk Management RD&A (RMRS); Fire Spread Research (Fire, Fuels, and Smoke Program, RMRS); Fire Economics Research (Human Dimensions Program, RMRS); and Fire and Aviation Management (Headquarters Office).

The WFDSC will play three key roles in meeting the agency's needs now and in the future for wildland fire decision support:

- Provide the venue for the development of new models and tools to support risk-informed decision making on large wildland fires;
- Support and advance the science underlying both existing models (e.g., WFDSS, FSPro, RAVAR, SCI, KDL) and new models as they become identified and developed;
- Deliver existing and future models to the field through focused technical and decision support consultation.

### **NWFDSC Monitoring Functions**

WFDSC will serve as the central portal for classification, monitoring and reporting of large fire incidents for which the Chief of the Forest Service has oversight responsibility. In this role, WFDSC will provide the essential information to implement the real-time monitoring and implementation identified in this Protocol.

#### ***Monitoring of Current Fire Conditions and Risk Classification of Fires***

The WFDSC will monitor current fire conditions using appropriate fire monitoring data, including:

- Number and location of total ignitions across the system;
- Number and location of incidents that have escaped initial attack across the system;
- Current and predicted weather conditions for escaped fire areas;



- Current and predicted national and regional preparedness levels, and
- Other measures as appropriate (e.g., values at risk, fire spread probabilities, fuels in areas of escaped fire, regional and local drawdown levels).

WFDSC will develop and implement a risk classification system for escaped fires that takes into consideration (a) the features of escaped fires including location, weather, fuels, and values at risk, and (b) long-term predictive information including seasonal forecasts, timing of season-ending events and anticipated boundaries given non-intervention, and (c) national, regional and local preparedness levels including the capability of local units (e.g., Type III Incident Management Teams) to conducting holding actions and other management activities (e.g., monitoring, point protection). The classification system will place escaped fires into one of five categories according to risk: Low, Moderate, High, Very High and Extreme Risk. In addition WFDSC will develop a science-based approach for identifying *fires of national significance* based on a combination of factors including incident characteristics as well as social and political factors.<sup>8</sup>

#### ***Decision Authority and Incident Management for Low, Moderate & High Risk Fires***

Fires classified as Low, High or Moderate Risk will be placed under the authority of the District Range or Forest Supervisor with oversight by the Regional Forester. Management of fires in these classifications will be according to appropriate to the complexity of the incident and will be assigned either a Type I, Type II or Type III Incident Management Team as appropriate. Fire management decisions will follow the standard guidelines for fire operations and management.

#### ***Decision Authority and Incident Management for Very High & Extreme Risk Fires***

Fires classified as *Very High* or *Extreme Risk* will be placed under the authority of the Regional Forester, with oversight by the Chief of the Forest Service. Management of fires classified as *Very High* or *Extreme Risk* will be assigned to either a NIMO or to a Type I or Type II Incident Management Team as appropriate.

Fire management decisions on those *Very High* and *Extreme Risk* fires managed by NIMO will be made according to the principles and guidelines established in the *National Incident Management Protocol for National Incident Management Organizations (NIMO)*.<sup>9</sup> Washington Office and Regional Office monitoring of NIMO-managed fires will be done according to the monitoring guidelines established with the NIMO Protocol.

Fire management decisions made by regular Type I or Type II Incident Management Teams will follow the normal practices of incident management. Washington Office and Regional Office monitoring of *Very High* and *Extreme Risk* fires managed by Type I and Type II Incident Management Teams will be done by assigning a *Large Fire Risk Monitor* to the incident.

#### ***Role and Assignment of the Large Fire Risk Monitor.***

<sup>8</sup> Fires of national significance are sometimes referred to as *megafires*.

<sup>9</sup> Full reference here to NIMO Incident Protocol.



For those *Very High* and *Extreme Risk* incidents *not* managed by NIMO, the WFDSC will assign a *Large Fire Risk Monitor* to obtain information relevant to fire monitoring and risk management. The Monitor will be assigned when the fire is classified as a fire of national significant by the WFDSC.

The Monitor will report to the WFDSC on a daily basis the progress made by the Incident Management Team toward develop the Fire Prospect. On initial contact with the Incident Management Team, the Large Fire Risk Monitor will meet with the Incident Commander to determine the current status of the fire, the management direction in place, and the status of the Fire Prospect.

If the Fire Prospect is completed, the Monitor will insure that the appropriate description of the Fire Prospect is completed and that the Fire Prospect is forwarded to the WFDSC. The WFDSC will then forward the Fire Prospect and associated documentation to the Washington Office. If the Fire Prospect is not completed, the Monitor will assist the Incident Management Team in consulting with the WFDSC to obtain any decision support that is needed.

The Monitor will remain on the incident until such time as the Fire Prospect is implemented and will be released from the incident at the discretion of the WFDSC or the appropriate authority at the regional or national level.

The Fire Prospect should contain, at a minimum:

- (a) A Fire Prospect map that includes expected boundaries of the controlled fire,
- (b) Expected size of the fire in acres,
- (c) Expected perimeter of the fire in chains, including chains associated with contingency lines;
- (d) Expected FFPC needed to conclude the fire,
- (e) Expected number of structures at risk,
- (f) List of resource values at risk,
- (g) Expected issues and considerations involving cooperators (e.g., CALFIRE) and the effect of such issues and considerations on the fire prospect, and
- (h) Expected political and social issues.

#### Assignment and Dispatch of Analytical Expertise

WFDSC will serve as a resource to incidents requiring technical and analytical expertise, and will assign personnel to incidents as needed and called for by incident management or by line authority and oversight as deemed appropriate. Analytical experts from WFDSC may be assigned to an incident on location, or may be assigned to an incident while in-residence at their normal place of work.

(Name some of the expertise here: Long Term Analysts, Fire Behavior Analysts, FSPro, RAVAR, RERAP)

Not the RP/FS/DR?

By mass RO/FS

Isn't this a  
RO job?  
No local knowledge  
No local awareness  
Not connected  
SA?



By page 6/11/13

### Preparation and Reporting of Daily Performance Metrics

WFDSC will be responsible for regular preparation and reporting to the Washington Office on the status of ongoing *Very High* and *Extreme Risk* incidents with respect to a set of key daily performance metrics. The daily performance metric report will include:

- (a) Fire Prospect Measures, including fire perimeter in chains (including contingency lines), area within the fire perimeter, days to achieve the Fire Prospect, and resources required to achieve the Fire Prospect.
- (b) Exposure Index (EI) calculated as the ratio (as a percentage) of suppression resources assigned to the incident relative to the FFPC (Firefighting Production Capability) required to achieve the current Fire Prospect
- (c) Percent of Retardant Effective
- (d) Percent Effectiveness of Point Protection
- (e) Efficacy of FF effort relative to 14-day FSPro 80% probability contour areas.
- (f) Other measures proposed for testing by the performance measure science panel.
- (g) Maximum Estimated Cost (Trigger: e.g., exceeds a predetermined percentile on the SCI)

**Comment [DM10]:** I moved the Maximum Estimated Cost to last position in the list below in case you wanted to delete it. We have been downplaying this aspect of performance and we may not want to highlight it (or even include it) here.

### Real-time Alerting for the Washington Office

WFDSC will be responsible for conducting real-time alerting to the Washington Office. This reporting will take the form of situational reports that provide alerts should one or more performance metrics reach pre-determined trigger conditions.

The Center will identify metrics that require trigger conditions. This identification will be done in consultation with the Washington Office. For each metric requiring a trigger condition, the WFDSC will:

- (a) Identify triggers for those metrics that have triggers.
- (b) Identify actions to be taken conditional on triggers.
- (c) Identify communication pathways when metrics triggered, including individuals or entities who will receive information as well as the management corrections suggested by metric triggers.
- (d) Alert Washington Office operations if metrics trigger conditions.
- (e) Prepare an ongoing and updated summary report of alerts.
- (f) Develop and maintain a web-based information system that supports the delivery of information on metrics and their trigger. The web-based information system will also serve as the portal for summary reports of alerts.

**Comment [DM11]:** I'm not pleased with this section yet. It seems a bit vague and needs to be more concrete.

### Fire Performance Reporting



WFDSC will prepare a final fire performance report for each incident. The performance report will include:

- (a) The final fire performance metrics based on the metrics identified above.
- (b) The performance metrics will be calculated for the total fire as well as for each incident command team assigned to the fire and for their assignment period.

The final performance report for each fire will be made available to the Washington Office through a web-based information system.

### ***Annual Fire Season Performance Report***

WFDSC will prepare an Annual Fire Season Performance Report based on the performance metrics established in this Protocol as well as their trigger conditions. The Report will summarize season performance according to:

- (a) Incidents at the national, regional and sub-regional levels;
- (b) Incidents according to the Risk Classification system established by WFDSC in accord with this Protocol.
- (c) Incidents by assigned Incident Management Teams as well as across all Incident Management Teams.
- (d) Incidents by other categories and strata as requested by the Washington Office.

In addition, for all *Very High* and *Extreme Risk* fires the WFDSC will conduct an analysis of the most recent fire season compared to the last five (5) fire seasons for all *Very High* and *Extreme Risk* fires.

### **Incident Data and Documentation Requirements**

The WFDSC will monitor and assure that incident data and documentation requirements outlined in this Protocol are met. Incident documentation for *Very High* and *Extreme Risk* incidents will include the use of *Google Earth* to document and update incident status, and will utilize layers that provide information about key incident features, including:

- (a) Fire perimeter;
- (b) Fire Prospect perimeter;
- (c) Description of the Fire Prospect;
- (d) Description of Alternative Fire Prospects considered but not implemented;
- (e) Location of primary and secondary control lines;
- (f) Location of contingency lines and point protection;
- (g) Location of fuel breaks that support current fire management objectives;
- (h) Positioning of key resources;



- (i) Model-based analyses (e.g., FSPro, RAVAR);
- (j) Information on retardant drops;
- (k) Cooperator issues; and
- (l) Stakeholder and political issues.

With respect to retardant drops, *Google Layers* will be used to identify and communicate the following:

- (a) Location (e.g., GPS coordinates) and timing of retardant drops,
- (b) Direction and spread of retardant drops;
- (c) Weather at the time of the retardant drop, including temperature, wind direction and relative humidity.
- (d) An indication of the operational or tactical objectives associated with the retardant drop.

WFDSC will establish a data repository for incident information and particularly for information pertaining to *Very High* and *Extreme Risk* fires, including:

- (a) Fire Prospect(s) and related documentation,
- (b) FSPro, RAVAR and other analyses used in the support of incident management,
- (c) Operational plans and summaries (e.g., IAP's, 209's).
- (d) WFDSS files and documents.



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## AFTER SEASON REVIEW

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The After Season Review provides for a review and written report of season attainments with respect to Protocol objectives. In addition, the Review provides an evaluation of season attainments with respect to the five-year goals identified in the Protocol.

The results of the Review are carried forward to an annual meeting with the OMB as well as other entities of interest. The Review will also be presented in a meeting with the senior fire leadership group and with the Executive Leadership Team.

A key focal point of the review is risk management and the execution of risk management principles on incidents during the season.

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## DEVELOP AND IMPLEMENT PLANS FOR IMPROVEMENT

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Plans for improvement will be developed and based on (a) the After Season Review, and (b) an updated National Fire Suppression Risk Assessment that includes an identification of critical risk issues and their mitigations.

The plan for improvement will be overseen by \_\_\_\_\_, and will include recommendations from \_\_\_\_\_ (e.g., who is involved?).

Plans for improvement will be implemented by (a) updating the National Fire Suppression Risk Assessment, (b) updating and revising, if needed, the National Incident Management Protocol, (c) updating and revising, if needed, the National Fire Suppression Risk Management Protocol, and (d) other documents and directives that enable and support continuous improvement in decision making.

**Comment [DM12]:** This needs to be articulated in more detail. This could be where we introduce the idea of a yearly, stand-alone risk assessment that draws from a number of sources including research and field units.



## Chapter Three – Annual National Fire Suppression Risk Assessment

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### OVERVIEW OF RISK ASSESSMENT APPROACH

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The essence of this Protocol is the application of risk management principles to the national fire management program. Risk management begins with risk assessment – the process of identifying events or conditions that result in potential harm or loss, providing an assessment of the likelihood that the event or condition would occur, and indicating the consequences associated with the occurrence of the event.<sup>10</sup> Risk management is the set of actions taken to mitigate or eliminate the potential loss by either (1) eliminating the event, or (2) reducing its likelihood of occurrence, or (3) minimizing or preventing its consequences.

This Protocol uses risk assessment and management as the methodology for identifying specific actions that lead to change in how the agency carries out its roles and responsibilities for fire management at the national level. Central to this approach is the conduct of an Annual National Fire Suppression Risk Assessment. This Assessment identifies a set of key risks the mitigation of which provides opportunities for continuous improvement with respect to the fire management program and its goals.

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### CRITICAL NATIONAL FIRE SUPPRESSION RISK ISSUES

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Risk is inherent to the fire management program and comes from a variety of sources that include (a) risks to the public and incident responders, (b) risks associated with incident decision making, planning and operations, (c) sociopolitical risks, (d) risks to the ecology, and (e) financial risks. Appendix A outlines in categorical form the inherent risks that the fire suppression program must manage to fulfill its organizational mission.

These risks fall into three general critical issue categories: Risks due to exposure to the hazards of wildland fire, risks due to organizational culture, and risks to the ecosystem. This section of the Protocol outlines in both narrative and tabular form the risks associated with wildland fire in terms of these three critical categories. Within each critical risk category are identified risk events, their consequences, their likelihood, their extent or scope and risk management and mitigation measures both currently in place and planned for the near term.

#### Exposure to the Risks of Wildland Fire

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<sup>10</sup> References: Kaplan & Garrick, Haimes & others.



Exposure to the risks of wildland fire can occur to both the public and to incident responders (see *table 1*). Public safety is the highest level priority for the fire management program. Nonetheless, the public is exposed to fire when it occurs in close proximity to residential areas (e.g., WUI). In addition, evacuation of the public from areas of exposure to fire risks itself imposes risks due to, for example, vehicle travel on congested evacuation routes as well as potentially low-visibility driving conditions. Diminished air quality also exposes the public to risks in the form of acute health effects and the potential for exacerbation of chronic respiratory conditions, particularly among at-risk populations such as the elderly. Finally, stress effects on members of the public occur whenever fire-related activities and fire effects (e.g., smoke) disrupt normal and routine living patterns and create uncertainty. Mitigation of risks to the public is currently accomplished by following standard operating practices for fire and aviation management. Future directions for public risk mitigation include regional scale monitoring for compliance along with best practices for managing public evacuations.

Incident responders, including firefighters and support personnel, are exposed to the risks of wildland fire by a number of pathways. First, fire suppression operations place firefighters in direct proximity to the fire itself, thereby leading to the possibility of fatality or injury due to burns. Of particular concern is the risk of burnover or entrapment, which tends to lead to either serious injury or death. In addition, fire operations are often conducted in the context of hazardous terrain that can lead to falls or other injuries associated with, for example, rolling rocks or falling tree snags.

Secondary effects from fire operations are also possible causes of fatality and injury. A significant risk to incident personnel is due to transportation either to or from an incident on public highways and roadways, or on an incident on narrow and uneven roadways when visibility is compromised by smoke or other obstructions. Heat and stress also pose significant risks to firefighters and can lead to fatalities due to heart attack and to health effects due to exhaustion.

The likelihood of fatalities among incident responders is relatively high on a seasonal basis. At present, interagency fire operations result in approximately 22 fatalities per year on an average annual basis.<sup>11</sup> About 25% of fatalities are Forest Service personnel. A key factor that influences fatalities is the amount of exposure of firefighters to the hazards of firefighting. Over the past five to eight years, we have seen a dramatic increase in the size of large fires and the total number of acres burned in all fires. This trend correlates highly with the increase in firefighter fatalities. Inefficient and/or ineffective fire management operations may lead to greater exposure of firefighters to the risks of fire than is necessary given the gains that can realistically be expected from such operations. In addition, overexposure leads to increased costs and associated downstream impacts to the agency's image and credibility.

**Comment [DM13]:** May want to expand this section to describe how fatalities are distributed by organization and by cause. Could also include a small graphic here.

<sup>11</sup> Reference the trend in fatalities.



<b>Entrapments and Burnovers. (4)</b>	<ul style="list-style-type: none"> <li>• Death and/or serious injury to firefighters</li> <li>• OSHA violations</li> <li>• Agency credibility</li> <li>• Increased costs</li> </ul>	<ul style="list-style-type: none"> <li>• Occurs an average of 3 years in 10.</li> <li>• Low extent.</li> </ul>	<ul style="list-style-type: none"> <li>○ Continue to follow best management safety practices.</li> <li>○ <b>Implement risk management monitoring system for Type III incidents that anticipates errors and aims to correct situational awareness before error chain lines up – Begin FY2010.</b></li> </ul>
<b>Aviation accident: helicopter, fixed wing &amp; air tankers. (10)</b>	<ul style="list-style-type: none"> <li>○ Deaths or serious injury of pilots, passengers and people on the ground.</li> <li>○ Loss of scarce and hard to replace equipment like ageing air tankers.</li> <li>○ Organizational credibility.</li> <li>○ Costs.</li> </ul>	<ul style="list-style-type: none"> <li>○ High probability</li> <li>○ Low extent</li> </ul>	<ul style="list-style-type: none"> <li>○ Follow best management practices.</li> <li>○ <b>Develop and deploy operations risk management approach to asset ordering and mission assignments, including, but not limited to, vetoing missions that are not worth the risk – Begin FY2009.</b></li> <li>○ <b>Develop and deploy mission performance metrics – Begin FY2009.</b></li> <li>○ <b>Implement “six sigma” level quality control system for maintenance, management and monitoring of all aviation assets – likely delivered via a contractor – Begin FY2010.</b></li> <li>○</li> </ul>

<sup>a</sup>Critical issues are shown in **bold** font.

<sup>b</sup>New or revised mitigation strategies are shown in **bold** font.

## Risks To Organizational Governance and Accountability

The agency’s organizational culture predisposes it to frame and solve problems in ways that sometimes create risks of various types, including risks to people, risks to the land, and financial risks that have widespread impacts (see *table 2*). Although safety is often stated as a top-level priority for fire management, the agency’s purported safety culture is not based on state-of-the-art principles that assure reporting and analysis of safety-related events that maximize learning. At present, the agency administrative process tends to focus on assigning blame for all errors, mistakes and routine violations rather than attempting to understand how the behaviors that led to such errors appeared at the time. As a result, relatively little is learned from the accidents that do occur and agency personnel are reluctant to provide information about near-misses and near-accidents that would be useful in understanding better how to reduce such occurrences. Given the relatively high rates of injury-accidents and fatalities that do occur in fire operations, the present “unjust-culture” only serves to promote the *status quo*. The creation of a “Just Culture” that emphasizes observing for risks as well as reporting errors and hazards would foster a more robust learning environment. Within this environment, acts, omissions and decisions are evaluated from the perspective of what would be expected from people of similar training and experience, with similar management direction, and in pursuit of similar goals and objectives. “Errors” in this model are not punished,



but rather are taken as a reflection of system properties that require identification, analysis and adjustment.

Organization culture also predisposes the agency to respond to political pressures in a number of contexts. Large fires tend to draw significant sociopolitical attention, which can lead to stakeholder and political representatives' demands for large or special efforts to be applied to fire management. In many cases, these efforts have a low probability of success, and result in high levels of exposure of incident personnel to hazards as well as higher costs. These outcomes in turn lead to problematic relationships with stakeholders, diversion of agency efforts from other important issues, and impacts to agency credibility.

At present, the agency experiences severe fiscal constraints on preparedness and suppression spending that imposes financial risks on the organization. The current 98%-effectiveness target for success in initial attack has become more difficult to achieve with the current appropriation for preparedness. To meet the shortfall in the preparedness account, funds are transferred from the suppression account, leaving that resource inadequate to fund suppression activities on the 2% of fires that do escape initial attack. The result is that each year the risk increases that the agency will have expended all funds in the suppression account before the fire season concludes. For the current fiscal year, 2009, the agency plans to charge \$370 million in preparedness expenses to the suppression account. This transfer will result in a 25% chance (based on the June forecast) of having sufficient funds in the suppression account for 2009 as compared to a 96% chance of having enough funds if the preparedness funds were not charged to the suppression account. Running out of suppression funds requires the Forest Service to transfer funds from other non-fire programs which leads to impacts to partners and cooperators, impacts to other agency programs, and impacts to agency image and credibility.

Organizational change to remedy these difficulties involves changing to a culture of risk-informed measured response. In addition, efficiency and effectiveness of resource deployment at national scale needs to be developed and fielded based on a risk-informed resource allocation system.



Table 2. National Fire Suppression Risk Assessment: Critical risks to organizational governance and accountability.

Event <sup>a</sup>	Consequence(s)	Probability of Event and Extent	Mitigation <sup>b</sup>
An “unjust culture.” (5)	<ul style="list-style-type: none"> <li>○ An “unjust culture” promotes agency safety ignorance because learning only takes place after serious accidents.</li> <li>○ A significant number of lessons are left unlearned.</li> <li>○ Significant decrease in probability to be able to prevent the next serious injury or fatality.</li> <li>○ Agency administrative process blames involved individuals for error, mistakes and routine violations.</li> <li>○ Agency fails to understand that “... Human fallibility is like gravity, weather, and terrain, just another foreseeable hazard, Error is pervasive... What is not pervasive are well-developed skills to detect and contain these errors at their early stages.” – Weick and Sutcliffe</li> <li>○ Agency fails to understand that “... To explain failure, do not try to find where people went wrong. Instead, find how people’s assessments and actions made sense at the time, given the circumstances that surrounded them.” – Dekker</li> </ul>	<ul style="list-style-type: none"> <li>○ 100%</li> <li>○ Broad extent.</li> </ul>	<ul style="list-style-type: none"> <li>○ Inform and educate internal and external stakeholders regarding vital important of creating a “Just Culture.”</li> <li>○ Develop and implement a “Just Culture” CFR that will serve to put in place an agency statute that details how employees that are involved in accidents will be treated.</li> <li>○ Encourage congressional community to repair the damage done by law requiring OIG investigations of entrapments.</li> <li>○ Enable learning how to prevent the next serious accident or fatality by establish an effective near miss, error, and routine violation information system.</li> <li>○ Begin 2010.</li> </ul>
Prolonged high-cost sociopolitical fire event. (6)	<ul style="list-style-type: none"> <li>○ Increased exposure and risk to firefighters.</li> <li>○ Increased effects on the land.</li> <li>○ Increased costs.</li> <li>○ Strained relationship with stakeholders.</li> </ul>	<ul style="list-style-type: none"> <li>○ .25% of fires – about 25 fires per year.</li> </ul>	<ul style="list-style-type: none"> <li>○ Implement strategy to improve decision making for very high and extreme risk fires – Begin FY2009.</li> <li>○ Develop and deploy performance metrics – Begin FY2009.</li> <li>○ Develop and deploy monitoring protocol – Begin FY2009.</li> <li>○ Develop and deploy real time error detection and correction protocol – Begin FY2009.</li> </ul>



<b>Corporate-scale inefficiency and/or ineffectiveness of resource deployment (allocation?) within or between GACCs: both during periods of scarcity (i.e. high PL levels) and abundance (i.e. low PL levels). (7)</b>	<ul style="list-style-type: none"> <li>Increased exposure and risk to firefighters.</li> <li>Increased effects on the land.</li> <li>Significant increase in costs.</li> <li>Strained relationship with stakeholders.</li> <li>Increased probability of running out of funds leading to fire transfer.</li> </ul>	<ul style="list-style-type: none"> <li>Potentially 2% or 200 of annual fires are subject to this risk.</li> </ul>	<ul style="list-style-type: none"> <li><b>Develop a science based risk informed resource allocation system: – Begin FY2010</b> <ul style="list-style-type: none"> <li>Provides information for concurrent incidents regarding risk, probability of success, resource utilization, hazardous fuels risk, weather risk, etc.</li> <li>Rates incidents as priority based on risk and potential advantage of additional resources or indicates incidents that are overexposed.</li> <li>Suggests optimal allocation of resources for concurrent incidents.</li> </ul> </li> </ul>
<b>Stakeholder and their political representatives' demand for Herculean efforts that have low probability of success and are high risk to firefighters. (8)</b>	<ul style="list-style-type: none"> <li>Increased exposure and risk to firefighters</li> <li>Increased effects on the land</li> <li>Increased costs</li> <li>Strained relationship with stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>.25% of fires – about 25 fires per year.</li> </ul>	<ul style="list-style-type: none"> <li><b>Develop and deploy risk communication with stakeholders – Begin FY2009.</b></li> <li><b>Develop and deploy vertical risk sharing with agency and executive branch – Begin FY2009.</b></li> </ul>
<b>Relationship and/or error creating a political issue. (9)</b>	<ul style="list-style-type: none"> <li>Distraction from more important issues</li> <li>Loss of situational awareness</li> <li>Agency credibility</li> </ul>	<ul style="list-style-type: none"> <li>Occurs every fire season</li> <li>Low to Moderate extent</li> </ul>	<ul style="list-style-type: none"> <li><b>Develop and deploy vertical risk sharing with agency and executive branch – Begin FY2009.</b></li> <li><b>Implement quality incident monitoring – Begin FY2009.</b></li> <li><b>Implement continuous improvement and learning system – Begin FY2009.</b></li> </ul>
<b>Distractions. (15)</b>			
<b>Large-scale multiple ignitions. (16)</b>	<ul style="list-style-type: none"> <li>Complex decision making.</li> <li>Resource allocation challenges.</li> <li>Multiple cooperators and stakeholders.</li> <li>"Triaging" of incidents to achieve best resource allocation.</li> </ul>	<ul style="list-style-type: none"> <li>High probability on a seasonal basis</li> <li>Moderate extent</li> </ul>	

**Comment [DM14]:** Might want to review this in light of the consequences noted for event #9 above.

**Comment [DM15]:** John – This is one of the two additional risk events you suggested. For your review/editing.



<p><b>Unable to fund preparedness expectation of 98% initial attack success rate out of preparedness appropriation. (11)</b></p>	<ul style="list-style-type: none"> <li>○ To meet the demand to achieve 98% initial attack success rate expectation, in FY 2009, the Forest Service plans to charge \$370 million preparedness expenses to suppression (preparedness charges charged to suppression include: pooled costs, aircraft contracts, some preparedness staff costs &amp; base-8 costs).</li> <li>○ Significantly increases probability that suppression funds will run out. According to the June National Suppression Forecast, the Forest Service has a 25% chance of having enough funds. If the \$370 million preparedness costs were not charged to suppression, there would be a 96% chance that funds would be sufficient.</li> <li>○ Increases the 10-year moving average by almost \$100 million dollars by FY 2009 more than it would have been without preparedness funds being charge to suppression..</li> <li>○ Preparedness organizational efficiency tends to be less because annual budget is supplemented by suppression as needed.</li> </ul>	<ul style="list-style-type: none"> <li>○ 100%</li> <li>○ Large extent</li> </ul>	<ul style="list-style-type: none"> <li>○ <b>Fix preparedness funding problem that tends to predispose the demand for fire transfer – Begin FY2010.</b></li> </ul>
<p><b>Running out of suppression funds.<sup>c</sup> (12)</b></p>	<ul style="list-style-type: none"> <li>○ Agency credibility</li> <li>○ Impacts to partners</li> <li>○ Impacts on the land</li> <li>○ Political fallout</li> <li>○ Impacts to programs that are impacted by fire transfer</li> </ul>	<ul style="list-style-type: none"> <li>○ June 2009 forecast indicates a 54% chance that funds will run out.</li> </ul>	<ul style="list-style-type: none"> <li>○ <b>Change culture of an “unbounded response regardless of risk” to a culture of a “risk informed measured response” – Begin FY2009</b></li> <li>○ <b>Implement strategy to improve decision making for very high and extreme risk fires – Begin FY2009</b></li> <li>○ <b>Develop and deploy performance metrics – Begin FY2009</b></li> <li>○ <b>Develop and deploy monitoring protocol – Begin FY2009</b></li> <li>○ <b>Develop and deploy real time error detection and correction protocol – Begin FY2009</b></li> </ul>

<sup>a</sup>Priority issues are shown in **bold** font.

<sup>b</sup>New or revised mitigation strategies are shown in **bold** font.

<sup>c</sup>According to the June National Suppression Forecast, the Forest Service has a 25% chance of having enough funds (75% chance of insufficient funds).



## Risks to the Ecosystem

The primary mission of the USDA Forest Service is the management of the nation's forests and grasslands. These resources comprise the ecosystems within which fire occurs and on behalf of which fire management is done. Historically, fire has played an important role in ecosystems. From a fire management perspective, the issue is one of continuing to permit fire to provide benefits to the ecosystem while at the same time restricting fire from doing damage to the ecosystem as well as to other resources that humans value, including infrastructure, environmental quality and recreational amenities.

Large-scale fires present fire management with the opportunity to restore fire to the ecosystem provided that it burns in areas and with intensities that reflect historical fire and its effects. However, large fires that burn unimpeded, with unmanaged behavior, and at high intensity levels damage the ecosystem. This can lead to risks to wildlife habitat, water quality, air quality and soil erosion. Subsequent risks include floods and silting of streams and waterways, with impacts to aquatic life (see *table 3*).

Table 3. National Fire Suppression Risk Assessment: Critical risks to the ecosystem and ecosystem health.

Event <sup>a</sup>	Consequences	Probability of Event and Extent	Mitigation <sup>b</sup>
Large scale indirect effect(s): air quality, floods, infrastructure. (13)	<ul style="list-style-type: none"> <li>○ Agency credibility.</li> <li>○ Impacts to partners.</li> <li>○ Impacts on the land.</li> <li>○ Political fallout.</li> <li>○ Impacts to programs that are impacted by fire transfer.</li> </ul>	<ul style="list-style-type: none"> <li>○ Low to moderate probability of occurring annually.</li> <li>○ Low extent.</li> </ul>	<ul style="list-style-type: none"> <li>○ Prevention of large scale fires.</li> <li>○ Insuring quality of emergency and long term rehabilitation efforts.</li> <li>○ Managing public expectations (e.g. air quality issues).</li> </ul>
Ineffective ecosystem restoration rate leads to overwhelming annual increase in hazardous fuels. <sup>c</sup> (14)	<ul style="list-style-type: none"> <li>○ Increased probability of mega-fire occurrence.</li> <li>○ Increased exposure to public &amp; incident responders to inherent risks of wildland fire.</li> <li>○ Environmental impacts including contribution to climate change.</li> <li>○ Increasing costs.</li> <li>○ Increasing serious accident and fatalities.</li> </ul>	<ul style="list-style-type: none"> <li>○ 100%</li> <li>○ Broad extent across all western fire adapted ecosystems.</li> </ul>	<ul style="list-style-type: none"> <li>○ <b>Implement an <i>Adapted Leadership</i> approach to developing a significantly new "Cohesive Strategy" that will have the following attributes:</b> <ul style="list-style-type: none"> <li>○ <b>Be implementable.</b></li> <li>○ <b>Achieve significant results over first five years of implementation and clearly leads to a manageable steady state restored fire adapted ecosystems.</b></li> <li>○ <b>Owned by American Public – likely will require Presidential leadership.</b></li> </ul> </li> </ul>

<sup>a</sup>Critical issues are shown in **bold** font.

<sup>b</sup>New or revised mitigation strategies are shown in **bold** font.

<sup>c</sup>A first order approximation of required disturbance compared with present amounts is 360% to 610% of total acres disturbed via fire and fuel treatments. Information derived from Bill Leenhouts. 1998. Assessment of biomass burning in the conterminous United States. Conservation Ecology.



A primary driver of large fires today is the abundance of natural fuels in many forests. At present, the national forest system is experiencing an imbalance with respect to the rate of growth of hazardous fuels. Although fuel treatment efforts are reducing the burden of hazardous fuels, the current rate of ingrowth is significantly exceeding outgrowth through acres burned and treated to a restored state. It is estimated that fire adapted ecosystems received between 360% to 610% more disturbance in pre-settlement times than what they receive today.<sup>12</sup> The result is a continuing, net increase in the amount of hazardous fuel, thereby increasing the risk of large fires and fire with extreme behavior. Current levels of agency expenditures for hazardous fuel management are insufficient to meet this changing need for fuel reduction. As a result, the out-of-balance conditions moves ever farther away from a steady-state norm where the amount of ingrowth is matched by the amount of outgrowth due to a combination fuel management and the presence of restorative fire conditions consistent with a fire adapted ecosystem.

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<sup>12</sup>Stephens, Scott L., Robert E. Martin, Nicholas E. Clinton. (2007). Prehistoric fire area and emissions from California's forests, woodlands, shrublands, and grasslands. *Forest Ecology and Management*, 251, 205–216.



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## APPENDICES

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### Appendix A: Inherent Risks of the Fire Suppression Program



## Appendix A: Inherent Risks of the National Fire Suppression Program

**Comment [DM16]:** I did not attempt format this more efficiently or aesthetically. We can deal with that later once we are sure how to present this material.

### Inherent Risks of the National Fire Suppression Program

#### *Risks to the Public and Incident Responders*

##### Risks to the Public

- Mortality (i.e., death) and morbidity (i.e., injury) associated directly or indirectly with the fire.
- Transportation-related accidents during evacuation.
- Stress associated with disruption and uncertainty, leading to medical effects (e.g., impaired health, emotional dysfunction)
- Stress associated with loss of residence or damage to residence (e.g., displacement, readjustment, potential PTSD).
- Health impacts from smoke particularly for at-risk populations such as the elderly and those with chronic respiratory health conditions (e.g., asthma, emphysema, pulmonary dysfunction or limited pulmonary capacity).

##### Risks To Incident Responders

- Entrapment and/or burnover.
- Hazards associated with transportation to, from and during incidents.
- Health effects due to heat and smoke.
- Health effects of stress and fatigue (e.g., heart attacks)
- Weather-related hazards (e.g., lightning, wind, snow, ice)
- Non-fire environmental hazards associated with the context of fire operations.
  - Slips, trips and falls.
  - Rolling/falling rocks, debris and snags.
  - Other environmental hazards (e.g. poison oak, insects, snakes).
- Overexposure to inherent risk factors.
- Insufficient analysis, identification and communication of safety and risk factors.
- Past tragic outcomes from incident burnovers have led to an “unjust culture” in the Forest Service. The prime example is the law that requires the OIG to investigate entrapment fatalities. The worlds leading safety experts indicate that a safe system must have the following:
  - Just culture which leads to:
  - Reporting culture which leads to
  - Flexible learning culture
  - Forest Service does not have an effective safety program because it does not learn from all the near misses, lapses and routine violations! This is especially troubling because there are numerous opportunities to learn how to prevent the next serious injury or fatality from near misses and procedure violations. The result is that the Forest Service only learns after serious accidents and fatalities.



*Risks Associated With Incident Decision making, Planning and Operations.*

- Inefficient operations associated with deploying too many or not enough resources.
- Ineffective operations associated with deploying resources at the wrong time and/or place.
- Ineffective deployment of resources during times of high demand (i.e., PL 4&5).
- Loss of situational awareness during transitional fires, during fire transitions and during large-fire complexes.
- Exceeding span of control.

*Sociopolitical Risks*

- Decisions and/or behavior of incident responders lead to poor relationships.
- Second guessing of decisions.
- Incident management that leads to political issues.

*Risks To the Natural Environment*

- Long-term risks associated with fire exclusion
- Significant annual increase in out of balance fire adapted landscapes leading to increase in hazardous fuels due to limiting fire and ineffective restoration rate – ingrowth into hazardous fuels exceeds what is burned and treated
- Air quality concerns due to smoke
- Mud and land slides
- Water, soil, plants, wildlife, insects

*Financial Risks*

- Using fire suppression dollars to supplement underfunded preparedness program by about \$400,000,000 predisposes running out of suppression funds leading to fire transfer and accountability concerns.
- Using suppression account to supplement preparedness via the use of “severity funding” further increases the risk that suppression fund will run out.
- Supplementing preparedness account by charging to suppression account and using severity funding inappropriately leads to increasing the size of the 10 year moving average of suppression funds thereby leading to acceleration of transfer of budget ceiling from other agency programs.
- Running out of suppression funds leads to fire transfer which leads to stakeholder concerns due to financial impacts of other Forest Service programs.
- Deficient governance system leading to stakeholder concerns about lack of financial accountability.
- Inefficient or ineffective operations leading to fires costing more than necessary.